results of a simple diuresis induced by the urea. This difficulty is avoided to some extent by limiting the patient's fluid intake for some hours before the test, but it is not entirely eliminated. No such difficulties arise in the urea clearance test, since volumes as well as urea concentration are taken into account mathematically by the van Slyke formulae.

In all the cases shown in Table II the routine renal function test, consisting of blood urea determination before urea, followed by a urea concentration test, was carried out, in addition to the clearance test already described.

In eight of them this routine test failed to show any impairment of renal function, yet all gave a urea clearance very definitely below the normal range. A careful consideration of all the facts obtainable clearly showed that renal function in these cases was definitely impaired, and left no doubt that the blood urea clearance value is the more correct index of the true state of the kidneys.

I have been making urea clearance determinations for some time now, in all cases where a renal function test has been required, and provided sufficient care and attention are paid to the two points I previously stressed—namely, complete emptying of the bladder and accurate timing of the specimens—I am convinced that the urea clearance is a much better index of the true state of renal function than the test formerly in routine use; I believe it to be, in fact, the best renal function test we possess.

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REVIEW OF BLADDER-NECK OBSTRUCTIONS

WITH SPECIAL REFERENCE TO TRANSURETHRAL PROSTATIC RESECTION *

BY

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It is perhaps not yet fully appreciated that the symptoms which are regarded as characteristic of an enlarged prostate are common to a number of other causes, not only in elderly men, but in other decades, as well as in the opposite sex. The same symptom group is referred to as diurnal or nocturnal enuresis in the young, frequency in adult life, and prostatism as senility is approached in the male.

The French were probably the first to point out that the urinary difficulties observed in elderly women were similar to those of prostatitis, but obviously due to other causes. From the same source we have the term "prostatisme sans prostate," when the symptom group is present without any obvious prostatic enlargement being felt per rectum. Accordingly, since this symptom group is common to various ages and both sexes, it is evident that full data should be obtained in each instance before an accurate diagnosis can be given and appropriate treatment instituted. In this paper, however, it has been considered advisable to review only the commoner conditions found in the male, and to exclude malignant disease.

The symptoms referred to are generally a gradually increasing urinary frequency by day and night, the quantities of urine voided at each act becoming smaller. The act may be precipitate, or there may be initial delay; the stream lacking in force and being smaller than normal, it thus takes longer to perform the act, which concludes with dribbling. Variations and additions to the above

will be noted as the individual causal lesions are discussed. This group of symptoms usually indicates some change at the bladder neck which is interfering with the proper emptying of the bladder. To appreciate the various types of obstruction that occur, and the changes they induce, let us briefly refresh our memories with the anatomy and physiology of the parts involved.

Anatomy

The Bladder.—The musculature of the bladder is described as divided into three parts: (a) The walls. (b) The trigone. (c) The vesical neck.

(a) The bladder is lined by a transitional epithelium which is continuous with that of the ureter and the urethra. The wall, aside from this epithelial lining, is made up chiefly of muscle fibres, arranged in an outer longitudinal and an inner circular manner. Because of these acting together on the bladder contents it is better to consider them as one muscle, the "detrusor" of the bladder. Between the musculature and the epithelial lining, or mucosa, is a loose cellular tissue, which is only absent over the trigone. Over the trigone the epithelial lining is firmly attached to the underlying muscle, while in all other portions of the cavity the epithelial lining is so loosely attached to the detrusor that when the organ is empty the epithelial lining falls into folds.

(b) The trigonal muscle develops in the embryo from the muscle layers surrounding the lower ends of the Wolffian ducts and ureters. Later in foetal life these muscles come to lie in the bladder, and their main bundles run from the ureteral orifices to the vesical orifice, where the bundles from the two sides join and run down, just beneath the urethral mucosa on the aspect posterior to and beyond the verumontanum. The upper margin of these bundles passes across from one ureteral orifice to the other, forming a slight elevation—the interureteric ridge—at either end of which the ureteral openings are situated.

(c) The term "neck" of the bladder is employed to designate the region around the vesical orifice. Here the division of the detrusor muscle into two layers is more marked. From each of the two layers, just posterior and lateral to the vesical orifice, is sent a strong band of muscle fibres, which runs down and forward to the prostate to form a loop around the front of the urethra. The bundle from the external longitudinal layer is thicker than that of the internal circular. These together form the "internal sphincter," which is not a circular muscle like the sphincter ani, but only forms an arch around two-thirds of the vesical orifice. The external sphincter is a voluntary muscle, while the "internal sphincter," being supplied by sympathetic and parasympathetic fibres, is an involuntary muscle.

The Prostate.—In the development of the prostate it will be recalled that, in about the twelfth week of foetal life, five groups of tubules grow out from the posterior urethra towards the bladder. At first the five lobes are distinct, but later the two lateral and the middle lobes tend to coalesce. The posterior lobe lying behind the ejaculatory ducts remains distinct. The anterior lobe, which commences by being the same size as the others, retrogresses after four weeks and is completely atrophied before adult life. In a few instances the tubules of the anterior lobe may persist and even be the seat, ultimately, of an enlargement. The lateral lobes, however, are the most active as to growth, and comprise the major portion of the adult prostate.

The Submucous Glands.—Lying under the mucous membrane of the posterior urethra and trigone, and independent of the prostate, are certain accessory glandular structures. They are localized in three situations: (a) the prostatic urethra; (b) the vicinity of the bladder neck; and (c) the trigone. These submucous glands are of importance, since, like the prostatic tubules, they are liable to undergo enlargement in middle and old age, and on account of their situation are likely to give rise to obstruction.

The subcervical group, known also as the glands of Albarran, consist of some thirty branched tubules, whose ducts open into the floor of the urethra proximal to the verumontanum.

The subtrigonal glands lie anywhere between the mid-point of the trigone and the bladder outlet, and are similarly composed of branched tubules. Enlargement of either of these groups may be sufficient to cause typical symptoms of

* Address to Dundee Branch, March 23rd, 1934.

prostatic obstruction, and some authorities maintain that a large percentage of so-called prostatic enlargements are really due to changes in these submucous glands, and not in the actual prostate itself.

Physiology

Considerable attention has been paid recently to the nerve mechanism of the bladder and the various reflexes involved during urination. For present purposes it will be sufficient to gain an impression of the resultant action.

The act of urination is initiated by a contraction of the trigonal muscle, which pulls open the vesical orifice; thereupon the detrusor steadily contracts on the contained urine till the latter is completely expelled. If changes have occurred which make the action of the trigonal muscle difficult its efforts to overcome the difficulty will result in hypertrophy—that is, the trigone becomes raised, the interureteric ridge accentuated, thickened, and approximated to the bladder neck because of the foreshortening associated with a chronic state of undue tonus. If, on the other hand, no impediment exists in the actual opening action of the bladder neck, but some narrowing or obstruction exists distal to the bladder neck, then the detrusor muscle will require to contend with overcoming this difficulty, and in consequence will hypertrophy.

In the relatively earlier stages, accordingly, the site of a lesion may be readily determined on cystoscopic inspection by ascertaining whether the trigone or the detrusor is undergoing hypertrophy. Later, as can be appreciated, both the detrusor and the trigone share in the hypertrophic changes.

Types of Lesions Producing Bladder-neck Obstruction

1. *Congenital*.—This consists of an annular diaphragmatic contracture mainly composed of the mucosal elements, and is morphologically similar to meatal atresia. The unfortunate owner of such a defect may pass into early adult life without appreciating the gravity of his state. The constant and progressive urinary frequency, being regarded as a personal idiosyncrasy, is tolerated till compensation finally breaks down, and medical aid is sought because of impaired health and early uraemic manifestations. On inspection a fully distended bladder is observed, and on further investigation the true cause of the trouble is found. It is probably in this type of case that the prostatic resectoscope achieves the most brilliant results.

There is another form of bladder-neck encroachment which should probably be placed under this category, since it has been observed in young boys—namely, the hypertrophic internal vesical sphincter. Its aetiology is obscure. The musculature of the internal sphincter, particularly that portion which is derived from the circular muscle and occupies the trigonal aspect of the neck, becomes progressively more accentuated, and with any undue stress may enter into acute spasm leading to urinary retention. A course of gradual dilatation with sounds may prove effective, but in marked cases it may be advisable to carry out a partial medial division of the sphincter at the trigonal aspect with a cutting diathermy electrode.

2. *Acquired*.—These comprise: (1) *muscular*, (2) *fibrous*, (3) *submucous adenoma*, and (4) *prostatic adenoma*. For simplicity only four types have been mentioned, and a pure form of each will be briefly discussed. Additional types are frequently cited, but these are usually an admixture of two or more of the above. Congestion, which is a common factor in most bladder-neck lesions, especially the prostatic, will be referred to later.

The muscular type is probably simply a perpetuation of the condition which has already been referred to under congenital. At the same time it can arise from some local irritation, as a ureteritis of the transmural portion of one or both ureters, or a polyp situated on the verumontanum. The changes observed are similar in

character to that already given. The trigonal portion of the sphincter can be markedly accentuated and raised well above the trigonal level. When unduly stimulated, a degree of spasm may ensue which precludes the proper emptying of the bladder and leads to attacks of urinary retention. The condition is not infrequently met with in highly strung, somewhat neurotic young men. The same treatment is advocated as under the congenital form.

The fibrous type.—This type is secondary to a long-standing inflammatory condition in the posterior urethra, and is usually associated with chronic prostatitis. The interstitial fibrosis commencing in the prostate may extend, not only to the bladder neck, but, since seminal vesiculitis is a common associate, also to the bladder base, impairing the physiological activity of the trigone. The evolution of this type is naturally slow and insidious, and of all forms of bladder-neck obstruction is the one which probably produces the greatest damage to the upper urinary tract. The slowness of its onset permits a more gradual compensation to occur, and extensive renal damage may be present without the individual presenting any obvious indications. In consequence, these cases require far more careful management in preparation for any corrective measures than do the relatively rapidly growing prostatic adenomas.

In the fibrous type symptoms have been present for many years—ten, fifteen, twenty, or longer. They commence insidiously in early adult life, and only become sufficiently marked to bring the individual for medical advice in the fifth to sixth decades. Per rectum the prostate is relatively small, somewhat irregular in contour, and on palpation is firmly elastic with varying areas of density. Tenderness may or may not be increased. Some are definitely hypersensitive. Secretion obtained by massage will usually reveal the presence of pus. On attempting lateral movement the prostate is more fixed in its bed than normal. In a case of marked chronic infection, bands of adhesions may be present, rendering the lateral borders of the prostate less evident.

Cystoscopically, the bladder neck shows a generalized annular contracture; hence the term "sclerosis of the vesical outlet." The secondary changes induced are hypertrophy of the trigone and accentuation of the interureteric ridge, with approximation of this to the bladder neck. The bladder detrusor usually shows some degree of hypertrophy, which in certain instances may be marked, with cellule formation and the presence of diverticula. Probably the greatest incidence of diverticula is found in fibrous bladder-neck contractures.

Median bar formation.—The condition which is most commonly referred to as median bar formation appears to be an admixture of the muscular and the fibrous types. In its simplest form this vesical neck obstruction is not associated with any appreciable changes in the prostate. The symptomatology is similar to that of the purely fibrous prostate, but may become sufficiently marked to bring the patient for relief at a somewhat earlier age. The changes at the vesical outlet show, in addition to a general contracture, a definite thickening of the trigonal segment, raising it into a horizontal, well-marked ridge. Histologically this bar presents a fibromuscular stroma which varies as to the percentage of the components. The best form of corrective procedure for the above two types of obstructive lesions is endoscopic resection, whereby a gutter is made in the trigonal portion sufficient to allow proper emptying of the bladder.

Submucous adenoma.—As previously indicated we are indebted to Albarran for differentiating this type from ordinary prostatic lesions. Where rectally the prostate presents no enlargement or adenomatous changes, and cystoscopically an enlarged middle lobe is found, we may presume that the condition is due to the subcervical

group of glands. Alteration of the subtrigonal glands will produce an apparent convex raising up of the trigonal floor adjacent to the outlet, the other findings being the same. A combination of the two groups will lead to a marked, almost polypoidal, projection arising from the trigonal aspect of the outlet. The symptomatology in such cases is of relatively short duration, and occurs more often from the sixth decade onwards, in the usual prostatic period. The situation of the obstruction is such that it very rapidly gives rise to bladder difficulty.

Local inspection will reveal a convex projection arising from the trigonal aspect of the bladder neck, its lateral borders meeting the margin of the outlet at a more or less acute angle to form a "notch." Should any old-standing inflammatory changes be present the angles of incidence will be rounded off into curves. By noting these configurations clinically one can readily arrive at the histological character of the condition present, and be able, by subsequent study of the removed tissue, to confirm the impression gained.

Prostatic adenoma.—The exact aetiology of prostatic adenoma is not yet understood. The lobes chiefly involved are the middle and the two lateral. The anterior lobe, as previously stated, usually atrophies, but may at times persist, and even become the seat of an adenoma. The rate and degree of enlargement in each of the three lobes may be approximately equal, but inequalities occur. Both lateral lobes may hypertrophy in the absence of the middle, and vice versa. One lateral lobe only may show enlargement, but it is more usual to find both involved, though one may be of greater size than the other.

Diagnosis and Treatment

Pending cystoscopic proof of the form of prostatic enlargement present, rectal examination will provide certain indications. If the lateral lobes are equally enlarged and show a definite intervening median furrow, the inference is that there is practically no median lobe present. If both lateral lobes are equally enlarged and the median furrow obliterated and replaced by a continuous convex surface passing from one lateral border of the prostate over to the other, one would anticipate finding an annular type of prostatic enlargement in which all three lobes—middle and two lateral—are practically coalesced, and encircling the bladder neck, with little intravesical projection. Where the upper limits of a prostatic enlargement appear to be somewhat ill-defined, especially at the "notch" in the upper mid-line between the seminal vesicles, one would anticipate finding evidence of intravesical projection with all three lobes contributing their respective convexities.

Cystoscopic examination can be carried out in the majority of prostatics without producing trauma or upset. It should only be done, however, towards the end of the preoperative course of treatment, when the patient is practically ready for operation. The information gained is of the greatest value in determining the mode and type of operative procedure best suited to the local condition present. With a collar type of fused trilobar enlargement there is practically symmetrical encroachment interrupted at 12 o'clock, and also at 5 and 7 o'clock, by notches which indicate the boundaries of the respective lobes. With a trilobar hypertrophy in which the individual lobes are differentiated, the vesical outlet is modified by convex encroachments due to each lateral lobe and the middle, so that the bladder picture is seen, as it were, through a triangular opening.

There is one factor which is important in most prostatic enlargements, and that is *congestion*. It is evident that the presence of a residual urine within the bladder, and the frequent efforts to urinate, will create a state of

congestion. Excessive intake of alcohol, exposure to cold, etc., tends to increase the congestion already present. Prostatic symptomatology does not follow a gradual course of increasing difficulty, as one would expect of a purely mechanical, slowly progressing obstruction. On the other hand, it is notorious how variable the symptoms may be. There may be periods of weeks or days on end with comparative comfort interspersed with corresponding times of marked difficulty. Even during a twenty-four-hour period it is usual to find that the symptoms are more troublesome at night, and that an appreciable initial delay is associated with each urination, and the stream becomes definitely thinner and lacking in force. All these evidences, and more, are indicative of congestion. Indeed, it is the factor of congestion which as a rule ultimately drives a patient to seek relief because of acute retention.

With regard to the treatment of bladder-neck obstructions, I have already suggested endoscopic resection as the operation of choice for several of the lesions discussed. As this type of operative procedure is rapidly gaining ground and being applied to prostatic enlargements with success, I feel that it may be of interest to outline the development of the method. The method has undoubtedly come to stay, but whether it will ultimately displace the open methods of surgical approach to the prostate—suprapubic or perineal—time alone will show.

Transurethral Prostatic Resection

Long before the Christian era instruments had been devised to relieve obstruction to the outflow of the urine, but the actual nature of the obstruction remained obscure.

It was not till 1830 that George Guthrie recognized that, apart from the prostatic enlargement, an equally serious impediment at the neck of the bladder was an elastic bar. He devised a special instrument like a metal prostatic catheter, at the end of which a small knife could be actuated to cut through the bar. In 1874 Bottini introduced his galvano-cautery, with which many cases of prostatic enlargement were successfully treated per urethram. Freudenberg improved on Bottini's instrument in 1897 by combining the galvano-cautery blade with the irrigating cystoscope, which had now come into use. In 1900 the pathology of the bladder neck was further enhanced by Albarran, who showed that what had been known as the median lobe of the prostate was actually no part of the prostate, but a development at the expense of the glands lying beneath the mucous membrane of the bladder neck, since known as the subcervical glands of Albarran.

From this outstanding contribution investigation by various observers led to the impression that prostatic hypertrophy almost always has its beginning in the subcervical glands, and ultimately involves the vesical sphincter, elevating the floor of the vesical neck, and pushing down the prostate—thus constituting the middle lobe or the horseshoe collar of trilobar adenomatous hypertrophy. Apart from prostatic enlargement, the other main obstructing factor at the bladder neck has received much diverse terminology, and in consequence a corresponding amount of confusion has arisen in referring to this condition in the literature. Among the various names are: median bar formation, the valve at the bladder neck, contracture of the vesical neck, median lobe hypertrophy, atrophy of the prostate, submucous fibrosis of the bladder neck, "prostatisme sans prostate," sclerosis or atony of the vesical orifice, musculo-glandular hypertrophy, hypertrophy of Albarran's subcervical glands, hypertrophy of the subtrigonal glands, aberrant or isolated median lobe prostatic hypertrophy, "maladie du col vesical," etc. All these indicate the horizontal median bar of hyperplastic tissue which contains all the elements of the vesical neck.

Types of Instrument Used

The present development of transurethral methods undoubtedly owes its inception to Hugh Young of Baltimore, who in 1909 described a "punch operation" for removal of the median bar by means of a modified endoscope. The method became widely used, but had drawbacks in that the actual cut was made blindly, and serious haemorrhage was not infrequently to be contended with. In the same year Beer of New York applied the Oudin monopolar current for the destruction of villous growths in the bladder, by employing a heavily insulated copper electrode through an ordinary catheterizing cystoscope. The procedure was a complete innovation and came to be known as "fulguration." Three years later—that is, in 1913—Stevens and Bugbee, working independently, reported cases in which they had applied fulguration to certain bladder-neck lesions, including enlarged middle prostatic lobes, with eminently satisfactory results. Luys of Paris soon followed with a similar procedure, which he termed "forage de la prostate." In 1920, Caulk of St. Louis evolved a cautery punch with which obstructing fibrous bars or small middle lobes could be removed under vision and without haemorrhage. This instrument with modifications has for some time now been extended by Caulk for the resection of enlarged prostates. Caulk claims that, after all obstructing portions of tissue at the bladder neck have been removed, and an adequate fresh channel is established, the prostate shrinks considerably in size. Although immediate post-operative bleeding is obviated, this instrument is apt to produce late haemorrhage when the slough comes away one or two weeks after operation. Further, the procedure tends to be followed by a rather high incidence of secondary infection. Kenneth Walker of London introduced in 1925 an ingenious diathermy punch, which, though proving extremely efficacious in certain forms of median bar formation, was yet difficult of application to others.

A fresh impetus was given to transurethral surgery in 1926, when Maximilian Stern presented his "resectoscope." In describing this new instrument he said:

"It has become possible to reduce the problem to a mere cystoscopic procedure by the evolution of a cutting current capable of operating in a water medium, and a cystoscopic instrument for its application. This instrument is provided with a small movable ring or loop of tungsten wire which, when actuated by a suitable current, is capable of removing longitudinal spaghetti-like sections of tissue. The former of these instruments I have named the 'resectotherm' and the latter the 'resectoscope.'"

The principle of Stern's instrument has since been applied to a number of electrotomes, each of which has been specially modified according to the ideas of individual urologists both in America and in Europe. Probably that of McCarthy of New York is as widely used as any. The claims for McCarthy's instrument are:

- (a) Accurate visualization of the prostatic urethra.
- (b) Greatest possible flexibility of manipulation, under vision, of the cutting loop.
- (c) Ample electrical power to excise the obstructing prostate under water, with a coincidental minimum of haemorrhage and of tissue coagulation.
- (d) Ease of interchange of electrodes for the closure of bleeding points.
- (e) At the completion of the operation, a No. F24 whistle-tipped indwelling catheter can be introduced through the sheath, before the latter is withdrawn: a definite time-saving and trauma-reducing procedure.
- (f) Rapid epithelialization with a minimum of cicatrization. The cutting electrical current employed is from a vacuum tube generator which gives 2,000,000 oscillations per second.

Advantages of Transurethral Operation

The transurethral route has proved itself the method of choice in dealing with congenital and acquired contractures of the vesical outlet. It is only comparatively recently, with the introduction of more efficient apparatus, that enlargements of the prostate have been treated by this means. Criticism naturally attends every new departure, and time alone will allow a proper perspective. Transurethral prostatic resection aims at re-establishing an adequate outflow from the bladder, without attempting to remove as much prostatic tissue as possible. The so-called radical operation of "prostatectomy" shells out only the adenoma, leaving behind a displaced capsule of prostatic tissue—from which, not infrequently, and if the patient lives long enough, fresh adenomata will develop. The open operation in a non-infected adenomatous case is extremely simple and leaves behind a clean prostatic bed, which on resolution provides a smooth channel and an excellent result.

Where chronic inflammatory reaction has been present prior to the development of adenomata the shelling out of the prostate is far from simple. We are all too familiar with the laborious effort entailed in such cases, an effort which is rewarded by the removal of fragmentary portions of dense tissue at the expense of bleeding and trauma with consequent shock. The degree of manipulation necessary tends to traumatize the prostatic venous plexus and invite the subsequent formation of thrombi. The convalescence in this type of case is, more frequently than not, a stormy one, and the after-result as regards the condition of bladder neck and posterior urethra in many instances such that the patient continues to have dysuria and frequency. In dealing with this particular type of prostatic lesion, accordingly, one cannot but feel that the resectoscope offers in competent hands a safer procedure at the time, and a better after-result than can be accomplished by the open route.

Each prostate case should be subjected to a careful routine examination, both general and local, and the exact form of bladder-neck obstruction determined by cystoscopy where possible. Infection, when present, should be corrected, and the congestion which is almost an invariable associate allowed to settle by appropriate means before any operative measures are contemplated. The mortality of prostatectomy has been reduced during the last twenty years mainly through more careful pre-operative care. With the application of transurethral methods there was a tendency at first to pay less attention to preoperative management, but it was soon revealed that as much care is necessary as when contemplating the open operation.

The technicalities of prostatic resection need not be entered into here, but there are a few points which may be mentioned. The procedure is relatively simple. The field of operation is visualized throughout the entire period. The altered bladder neck is trimmed down step by step till a clear channel extends from the trigonal floor down to the upper aspect of the verumontanum. It is wiser, in the interests of an enfeebled patient, not to attempt to remove too much tissue at one sitting, but to conclude after the main obstructing portion has been dealt with. The more raw surface exposed, the more is absorption likely to take place. Further, as the cutting loop of the electrode enters deeper planes, some bleeding is apt to be induced which may take longer than anticipated to stop. It must be remembered also that the electrodes generate heat, and the more cuts made the greater will the tissue be heated up, thus encouraging ultimate slough formation, and possibly secondary haemorrhage. It is evident that if, instead of one operation which might endanger life, the process can be

conveniently subdivided into two or three, carried out without any undue risk, the latter course is to be preferred.

After-treatment

The procedure following transurethral resection is that a retention catheter is left in for two to three days. After its removal the patient can get up, and is able to void as required. At first, owing to reaction oedema, the voidings may not be complete, and it is as well in such cases to carry out intermittent catheterization morning and evening, instilling argyrol or silver nitrate solution after the bladder is empty and before removing the catheter. This may require to be done for four to five days, after which the patient can return home. As a rule a period of a week to ten days is sufficient for the post-operative course. For debilitated, senile patients, a longer period under supervision is advisable. In cases of fibrous prostate with long-standing contracture of the vesical outlet, the bladder tone is usually much impaired, and although a free outflow has been established, some time may elapse before the detrusor tone is sufficiently established to effect complete emptying of the bladder. In such cases silver nitrate irrigations have proved of the greatest value.

A repeat operation, if the primary procedure has not come up to expectations, should not be considered until all immediate local reaction has settled and the prostate has had some time to shrink. Reinspection of the operative field after three weeks will reveal complete epithelialization, and as a rule no trace of sloughs. Each case, however, should be individually judged as to the general as well as to the local condition, before further intervention is deemed advisable. A repeat operation is invariably easier to perform and necessitates a much shorter period of care, since no further course of preoperative preparation is called for. If the procedure is carried out as above outlined there is no operative shock, and no subsequent pain, nor is the patient confined to bed for longer than a period of three to four days throughout the entire course of corrective treatment.

Conclusion

The laity tends to think that any operation carried out after the age of 60 is a "do or die" performance, but it is the duty of the profession and of science to minimize risk and prolong life. It is because such a forlorn view of prostatectomy is taken by the majority of people—including some members of the medical profession—that victims of prostatism carry on with their complaint till finally an acute obstruction brings them suddenly face to face with the fact that at last something has to be done, and they are by this time reconciled to the worst. It is just this aspect of prostatic and bladder-neck trouble which one would like to emphasize. Why allow a patient to go on with obstructive urinary symptoms till the prostate is sufficiently ripened to permit of enucleation, when all the time progressive renal impairment is taking place, and the patient's general system is becoming more toxic and less able for surgical intervention?

Now that we have the means of determining and correcting such troubles, even in their incipient stages, is it not in the interests of common sense and the community at large, that these individuals be immediately attended to, and saved unnecessary years of suffering and impairment?

It has been said: "The surgery of the obstructing prostate of to-day involves an appreciation of the necessity of its early recognition as well as its prompt correction when the patient shows his greatest credit balance in resilient arteries and other physical assets, and before he has got well along the inevitable road to material depreciation of those assets. Moreover, he can and should have this journey made easier and the road longer."

HIGH CARBOHYDRATE DIETS AND INSULIN EFFICIENCY

BY

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During the last four years the use of diets containing a relatively large quantity of carbohydrate has become more and more common in the treatment of diabetes mellitus. When these diets were first introduced they were received with many theoretical objections, but their undeniable success rapidly compelled their serious consideration and encouraged their increasing acceptance. This divergence between theoretical objection and practical success is no minor discrepancy capable of easy adjustment after careful revision of the data, but a definite conflict between two diametrically opposed conclusions. On the one hand, a well-founded theory directs that the carbohydrates in the diabetic's diet must be curtailed if health is to be preserved; whilst, on the other, a brilliant piece of clinical empiricism produces irrefutable proof that a liberal allowance of carbohydrate acts favourably on the diabetic's health. At present it may be said that the theoretical objections are securely established, not only on a logical sequence of experimental results, but also on the accumulated clinical experience of diabetes mellitus before the introduction of insulin; whilst the beneficial effects attending the use of high carbohydrate diets are inexplicable either by any known physiological or pathological mechanism, or on the basis of previous clinical experience. A probable clue as to the nature of the discrepancy is suggested by a consideration of the chronological relation of the conflicting views.

The good results following the use of high carbohydrate diets were not discovered until after the introduction of insulin treatment. This suggests that there exists in the body a mechanism capable of stimulating the utilization of carbohydrate, but which cannot exert its action in the absence of an adequate supply of insulin. It was with the object of searching for this mechanism that the present work was undertaken, and the employment of healthy men as subjects for the search was dictated by the supposition that it would only be possible to detect the unknown mechanism in subjects possessing the normal supply of insulin.

Theoretical Objections to High Carbohydrate Diet

Before discussing the present research it is first necessary to glance at the work upon which the theoretical objections to the use of high carbohydrate diets in diabetes are based. For a long time it has been known that the excessive consumption of carbohydrate by the diabetic results in deterioration of his clinical condition. It was not, however, until a few years before the discovery of insulin that light was thrown, by the work of F. M. Allen and his collaborators, on the mechanism of this unfavourable clinical change. Allen studied the effect of diet upon the health of partially depancreatized dogs, and summed up his results by saying:¹

"Dogs which have lost a certain amount of pancreatic tissue will become diabetic irrespective of diet. Dogs which retain a sufficient amount of pancreatic tissue will never become diabetic irrespective of diet. But between these two groups is an intermediate group. On an Eskimo diet they may be found to live in health. On a Hindu diet they soon go down to fatal diabetes."

Thus if sufficient pancreas is removed from a dog so that it is on the borderline of pancreatic diabetes the animal lives, if it receives a low carbohydrate diet, and the blood sugar remains low and glycosuria does not occur. But if such an animal is given a diet rich in